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NAVAL WEAPONS ENGINEERING SUPPORT ACTIVITY WASHINGTON DC F/6 15/5
NAVAL AIR SYSTEMS COMMAND AVIONICS LEVEL OF REPAIR MODEL, MOD-I--ETC(U)
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NAVAL AIR SYSTEMS COMMAND
AVIONICS LEVEL OF REPAIR
MODEL, MOD-III DEFAULT
DATA GUIDE

10 1 November 1978

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Introduction

This guide is a supplement to the data development and analysis required for performing LOR (Level of Repair) analyses on avionics equipment using the MOD-III versions of the NAVAIRSYSCOM (Naval Air Systems Command) LOR computer model. This guide was developed on the premise that certain LOR input data values do not vary significantly across the spectrum of avionic equipments. Based on this premise, all MOD-III avionics LOR input data elements were analyzed to determine which could be assigned a default value that will seldom vary with the avionic equipment being analyzed. This resulted in establishing default values for 20 LOR input data elements. These values are provided in this guide along with the sources of raw data and the analytic procedure used in their derivation.

Some LOR data elements could not be properly reduced to a single default value. In these cases, a range of values and directions for selecting from the range are provided.

LOR analysts should only use the default values if better values are not available. If the analyst needs more detailed or specific information on any data element, and it is not readily available, he should contact NAVWPNEINGSUPPACT (Naval Weapons Engineering Support Activity). Updates to this guide will be made as necessary by the NAVAIRSYSCOM.

All suggested corrections or questions should be forwarded to, NAVWPNEINGSUPPACT, Engineering Analysis (ESA-831), Washington Navy Yard, Washington, D.C. 20374, phone 202-433-4060 or Autovon 288-4060.

Default Data Elements

1. Data Element: Discount Rate

a. Default Value: .10 (10%)

b. Source/Derivation: SECNAV Instruction 7000.14B dated 18 June 1975 Titled "Economic Analysis and Program Evaluation for Navy Resource Management" prescribes a discount rate of 10 percent as the effective rate of return on investment after adjusting for inflation to discount future costs.

2. Date Element: Required Days of Stock

a. Default Values:

1) Discard:

- a) Carrier based - 90 days
- b) Land based - 90 days

2) Repair:

- a) Carrier based - 90 days
- b) CONUS Land Based - 30 days
- c) Overseas Land based - 60 days

b. Source/Derivation: OPNAVINST 4441.12A change #1, dated 13 Mar 75 states "Authorized stock levels for repairable items at operating sites will be 90 days for afloat units and MAGs (Marine Aircraft Groups), 30 days for CONUS activities and 60 days for overseas activities. Stockage objectives for expense/consumable items will not exceed 90 days for afloat units and MAGs (based on combat rates) or ashore (Based on peacetime rates), unless the Fleet CINC authorizes endurance loading for a specified ship deployment."

3. Data Element: BCM (Beyond Capability of Maintenance) Rate

a. Default Values:

- 1) Intermediate (WRA) - .063
- 2) Intermediate (SRA) - .021

b. Source/Derivation: Data used in the determination of the default values were derived from BCM codes 2-8 in the 3-M Type Equipment Work Unit Code Report for work unit codes on the following aircraft: E-2, F-4, F-14, P-3A, P-3B, P-3C and S-3A for the period of January 1975 through December 1977.

4. Data Element: Personnel Attrition Rate

a. Default Values:

- 1) Military - .450 (45.0% per year)
- 2) Civilian - .139 (13.9% per year)

b. Source/Derivation: Information provided by the Bureau of Naval Personnel (Pers 21) indicates a strength of 15,001 AT's (Avionics Technicians), AQ's (Aviation Fire Control Technicians) and AX's (Aviation ASW Technicians) with pay grades of E-3 to E-7 at the end of FY-74. Naval Air Maintenance Training Group, Memphis, Tenn., information indicated that the total training completions for AT's, AQ's and AX's from "C" school for avionics equipment during the same time period were 6750. This results in a attrition rate of .45.

Information on the civilian avionics technicians attrition at the six NARFs was obtained from NAVAIRSYSCOM (AIR 414) Depot Management Division. The average rate of the six NARFs was 13.9% during CY-74. This figure is derived as noted in the following table.

Total (Avionics Personnel Only)			
NARF	Ave. Strength	Separations	Attrition (%)
	CY74	CY74	CY74
Jacksonville	512	22	4.30
Norfolk	987	69	7.52
Pensacola	622	81	14.97
Cherry Point	423	63	17.50
North Island	1166	249	27.15
Alameda	1057	178	20.25
Total	4767	662	13.90%

All figures in the above table are figures obtained for CY-74. An updated CY-77 figure was not available.

5. Data Element: Hourly Rate (Labor)

a. Default Values:

1) Military

- a. CV Based - \$8.14/hr
- b. NAS Based - \$10.71/hr
- c. Weighted Avg - \$9.94/hr

2) Civilian (Depot) - \$30.66/hr Avg.

b. Source/Derivation: Information provided by the Bureau of Naval Personnel (Pers 21) indicated that the average grade of all ATs, AQs, AXs, and AEs now in the Navy is an E-5. The average billet cost of the total number of these classifications was found to be \$16,529 per year from the Navy Personnel Research and Development Center, San Diego study "Life-Cycle Navy Enlisted Billet Cost Tables FY-78" Per-02, July 1978. To be able to state this cost on a per hour basis, the total availability of ATs, AQs, AXs, and AEs in hours per year was required. This value was found in OPNAVINST 5330.8 "Navy Standard Work Weeks for Enlisted Personnel" to be 1543.3 hours per year for shore based personnel and 2030.6 hours per year for carrier based personnel. Dividing these figures into the billet cost found previously yields the default values stated.

The Civilian Depot Labor Rate for FY 77 was determined from data obtained from the NALC (Navy Avionics Logistics Center), Component Division. If the NARF for a particular LOR study is not known, the average value of \$30.66 per hour should be used.

<u>NARF</u>	<u>LABOR</u>	<u>OVERHEAD</u>	<u>TOTAL</u>
Alameda	\$ 12.58/hr.	\$ 20.06/hr.	\$ 32.64/hr.
Cherry Point	\$ 11.39/hr.	\$ 17.04/hr.	\$ 28.43/hr.
Jacksonville	\$ 11.74/hr.	\$ 20.75/hr.	\$ 32.49/hr.
Norfolk	\$ 10.00/hr.	\$ 19.97/hr.	\$ 29.97/hr.
North Island	\$ 11.26/hr.	\$ 17.27/hr.	\$ 28.53/hr.
Pensacola	\$ 11.19/hr.	\$ 20.72/hr.	\$ 31.91/hr.
Average	\$ 11.36/hr.	\$ 19.30/hr.	\$ 30.66/hr.

6. Data Element: Item Entry and Item Retention Cost

a. Default Value:

- 1) Item Entry - \$455.00/Item (expected value)
- \$409.00 - \$501.00/Item (acceptable range)
- 2) Item Retention - \$225.00/Item/Year (Expected value)
- \$202.00 - \$248.00/Item/year (acceptable range)

b. Source/Derivation: These values were derived from a sampling of previous Navy experience. Values were collected from various Navy Activities which utilize these data elements in their functions and from the Air Force Logistics Command (AFLC) at Wright-Patterson, AFB. These Navy activities included Aviation Supply Office (ASO) or Ships Parts Control Center (SPCC), the Navy supply points; land based facilities (both base and shop costs); and carriers. The costs include labor costs, administrative costs, and ADP costs. Warehousing costs for the actual item are not included. These values were analyzed, then averaged, and finally sensitized 10% in both directions to obtain the resulting values.

Item entry cost consists of a non-recurring cost of \$455.00 to enter a new NSN (National Stock Number) into the NSS (National Stock System). Item retention cost is a recurring cost of \$225.00 per year to maintain one NSN in the NSS per year. Both these values are still being researched in greater depth by the Navy and the AFLC.

The lower end of the range is suggested for studies where the items under consideration are simple, with a high population. Conversely, the upper end of the range should be used for studies of very complex items and low population. Note: Updated values for CY-77 are not now available.

7. Data Element: Field Supply Administration Cost

a. Default Value: \$17.63/Item/Site/Year

b. Source/Derivation: The value for Field Supply Administration cost was derived from a study of Navy supply activities in conjunction with a continuous study by AFLC (Air Force Logistics Command) Wright-Patterson AFB. Field Supply Administration is the cost of maintaining one item type at one site for one year. ADP, labor, and administrative costs are included. Warehousing costs are not included.

8. Data Element: Transportation Cost

a. Default Value: \$.0001245/pound/mile

b. Source/Derivation: Transportation charges are derived from AF Regulation 76-11 Military Airlift, U.S. Government Rate Tariffs effective 1 January 1975. The value given is \$.249/ton/mile/ or \$.0001245/pound/mile. The minimum rate charged is for a shipment of at least 12 pounds; however, avionics items are generally transported in standard containers with any total shipment being greater than 12 pounds. These costs are for military service only. Commercial rates are slightly higher depending on place of origin and destination, but the above quoted military airlift charges will be the default value.

Since this default value is a cost per pound per mile and the LOR model only considers cost per pound basis, some external calculation is required by the analyst. Transportation from the sites in terms of an average mileage transported must be multiplied by the default value before entering into computer model. The average distance to a Depot is 370 miles for shorebased sites and 4962 miles for carrier based sites.

9. Data Element: Packaging Cost

a. Default Value:

- 1) Item - \$133.20 cu/ft.
- 2) SRA - \$1.85 per unit
- 3) WRA - \$3.59 per unit

b. Source/Derivation: The standard material and processing list for SRAs of the PWB (Printed Wiring Board) type is documented in Military Standard 90363A. Cost and direct man-hours required for complete packaging of an SRA of this type is found in NAVSUPINST 4030.30, "Packaging Cost Estimating" dated 10 January 1973. Cost Breakdown results in a \$.55/Item cost of material and \$1.30/Item cost for direct man-hours. The standard material and processing list for WRAs is documented in Military Standard 90407A. Cost and direct maintenance man-hours required for complete packaging of a WRA is also found in NAVSUPINST 4030.30. Cost breakdown results in a \$1.80/Item cost for direct man-hours and \$1.79/Item for material. This value is applicable for an average WRA that is approximately 50 lbs. and a total surface area of approximately 1,000 square inches. Cost breakdown results in a cubic foot cost of \$133.20/cubic ft.

c. Packaging costs vary depending upon the type of equipment being packaged and the type of container being used. The above values are average values for standard size SRA's and WRA's. For studies on peculiar equipments or those equipments requiring special packaging, consult NAVSUPINST 4030.30. Note: Updated values for CY-77 are not presently available.

10. Data Element: Material Rate

a. Default Value: .108 (10.8%)

b. Source/Derivation: Information received from NAVAIRSYSCOM (AIR-414) indicates that material rate is included in the NARF Component Rate per Direct Manhours as a per hour charge. The material rate for the six NARF's considered was an average of \$15.21/hr. In order to derive a material rate as a percentage of assembly cost, an analysis of 650 SRAs was used to determine their material rate percentage based on their required direct maintenance manhours, at \$15.21/hour, with a standard deviation of .136 (13.6%). This indicated that for each LOR analysis the material rate should be calculated as:

$$\text{Material Rate (\%)} = \frac{\text{Material Rate (per hour)} \times \text{Direct Maintenance Manhours (Repair)}}{\text{Assembly Cost}}$$

Material Rate on a per hour basis should be taken from the following chart if the particular NARF is known. If not, the average value of \$15.21 can be used.

<u>NARF</u>	<u>Material Rate (\$/hour)</u>
Alameda	\$13.12/hour
Cherry Point	\$17.46
Jacksonville	\$12.48
Norfolk	\$18.33
North Island	\$18.79
Pensacola	\$11.07

AVERAGE \$15.21

c. This is one possible method for calculating repair material rate. This method is applicable to the lowest indenture level item only. Any item that is made up of lower indentured items other than piece parts (i.e. WRA) is assigned a repair material rate of 0.0. For an item that is made up of a lower indenture level item and individual piece parts, special consideration must be made in deriving this data element. The MOD-III user's guide must be consulted for proper evaluation.

d. The above data was obtained from NAVAIRSYSCOM 414 for use in the MOD-III Default Data Guide. These figures are based on the results of the FY 77 Work Load Conference.

11. Data Element: Documentation Cost

a. Default Value:

(by complexity)	
1) Below Average Complexity	- \$241.00/page
2) Average Complexity	- \$338.00/page
3) Above Average Complexity	- \$367.00/page
(by equipment type)	
4) Airframe	- \$255.00/page
5) Armaments	- \$198.00/page
6) Common Avionics	- \$255.00/page
7) Complex Systems	- \$331.00/page

b. Source/Derivation: Information on cost of documentation was obtained from NATSF (Naval Air Technical Services Facility). The average cost of a new basic manual for

an equipment procurement is \$315.00/page. The average cost of a set of changes or revision pages for an equipment is \$268.03/page. Additional information is presented here for different levels of complexity of equipment by geographic areas. It should be noted that the contractors overhead rate and geographic location often influences data acquisition costs.

Contractor averages by geographic area	Complexity		Changes and Revisions (Complexity)	
	Low	Average	Average	High
East Coast		299.66	352.31	277.96 304.67
West Coast	241.19	504.64	641.22	318.70
Central & Southwest		198.85	245.67	146.62 331.66

c) These costs are based on the initial summary by NATSF. Since this summary was compiled, costs have increased by 25% due to inflation. However, use of newer specifications concerned with comprehensibility, readability, and microreproduction compatibility have, reduced page content costs by 15%. Both of these percentages are reflected in the given costs.

12. Data Element: Deployment Factor

a. Default Value: 0.3012

b. Source/Derivation: Information was obtained from the Carrier Employment Support Planning Document, dated 24 February 1977 for use in CY-1977 through 1981. The carrier deployment factor for a squadron is identical to the deployment factor of the carrier to which it is assigned. The squadron's deployment factor at a NAS is the complement of the carrier deployment factor (i.e., 1.0 - carrier deployment factor for that squadron).

c. The value given is the average of the carrier deployment factors. This value should only be used when the carrier is not known or when several carriers are involved. If exact deployment factors are needed, contract NAVWPNEGSUPPACT (ESA-831).

13. Data Element: Support of Support Equipment

- a. Default Value: .26/year for first year
.12/year for subsequent years

b. Source/Derivation: The values given were derived by NAVWPNEINGSUPPACT (ESA-8), they are based on experience. Included in these figures are the costs of document revisions, LOR analysis, MEA, initial spares, replenishment parts and engineering changes to the support equipment. Calibration of the support equipment is not included. However, if the analyst finds calibration costs significant in any particular analysis, their value should be included as an addition to the default value.

14. Data Element: Safety Level

- a. Default Value: 6.57 weeks

b. Source/Derivation: Information from ASO (Aviation Supply Office) Financial Control Division indicates that the funding level for FY 1977 authorizes a safety level of 46 days (6.57 weeks) for calculating inventory. Note: An updated value is not now available.

15. Data Elements: Procurement Leadtime

- a. Default Value: 108 weeks

b. Source/Derivation: Information on procurement leadtime was obtained from the Naval Air Systems Command, Material Management Division. Procurement leadtime varies from a minimum of 18 months to a maximum of 36 months. Using the value of 108 weeks as an input value is only recommended if better information is not available.

16. Data Element: Training Cost

- a. Default Value: \$21.84/hour

b. Source/Derivation: Cost per hour for training in the avionics and electronics field at the "C" school level was obtained from Chief of Naval Education and Training Pensacola, Florida. The value given was \$21.84 per student hour. This cost includes O&MN (Operation and Maintenance, Navy), MPN (Military Personnel, Navy), and OPN (Other Procurement, Navy)

related appropriations for direct training, direct support, and indirect support costs. Student pay and allowances are also included.

17. Date Element: Repair Cycle Time

a. Default Value:

- 1) Local (Carrier Based) 3 Days
- 2) Local (Land Based) 3 Days
- 3) Local PIMA 9 days
- 4) CV-PIMA 79 days
- 5) LB-PIMA 79 days
- 6) CV-Depot 93 days
- 7) Land Based-Depot 93 days
- 8) CV-PIMA-Depot 103 days
- 9) LB-PIMA-Depot 103 days

b. Source/Derivation: Standard Value for repair cycle time was obtained by a review of 3M data and records in the following Activities:

- 1) Naval Air Systems Command, Material Management Division
- 2) Naval Air Systems Command Representative Atlantic
- 3) Naval Air Rework Facility, Cherry Point, North Carolina
- 4) Naval Air Rework Facility, Jacksonville, Florida
- 5) Naval Air Rework Facility, Pensacola, Florida
- 6) Intermediate Maintenance Activity, Jacksonville, Florida
- 7) Intermediate Maintenance Activity, Oceana Naval Air Station, Virginia
- 8) Air Intermediate Maintenance Department, USS America (CV-66)

c. The standard value of 3 days for repair cycle time local repair was obtained from ASOINST P4423.32 dated 28 March 1974. The repair cycle time of 9 days for PIMA is valid only if the PIMA is in the immediate area of the aircraft. In those cases where transportation will be required, an average of 35 days each way should be added to make a total of 79 days for repair cycle time in PIMA. The 93 days for Depot Repair cycle time includes the following average times.

- 1) Intermediate Maintenance Activity processing time for components that are BCM
- 2) Average transportation elapsed time 35 days to the NARF
- 3) Average NARF repair time 20 days
- 4) Average transportation elapsed time of 35 days after repair to the operating site

d. The required days of stock for these alternatives is 90 days, repair cycle time would affect the cost of maintenance alternative only if the repair cycle time were determined to be greater than 90 days.

18. Data Element: Space Cost

a. Default Value:

- 1) GSE Space and Work Space
 - a) Carrier Based - \$43.66/ft²/year
 - b) Land based - \$3.47/ft²/year
- 2) Inventory Storage Space
 - a) Carrier Based - \$7.32/ft³/year
 - b) Land Based - \$.578/ft³/year

b. Source/Derivation:

1) GSE space and work space costs for carrier based sites were derived based on the cost of ship alteration necessary to establish an avionics shop. The cost of ship alterations were obtained from the PERA(CV) (Planning and Engineering for Repairs and Alterations of Carriers), SHIPALT (Ship Alteration Record) Data Bank at NAVAIRSYSCOM via a report by Grumman Aerospace Corporation for NAVAIRSYSCOM titled "Final Report Out-of-Production Aircraft S-2E/G Level of Repair Conversion Cost Study" 29 June 1973. The average cost of these ship alterations was \$250/ft². Amortized over a ten year period, considering time value of money, this yields a space cost of \$43.66/ft²/year.

2) GSE space and repair work space costs for land based sites were derived from commercial rates for this type of space. Research by NAVWPNEINGSUPPACT yielded a value of \$3.47/ft²/year for this cost.

3) Inventory storage space costs were derived from considering that there are six cubic feet per square foot of floor space. Therefore, the values for GSE and repair work space cost were divided by six to yield \$7.32 and \$.578 per cubic foot per year for carrier based and land based sites, respectively.

19. Data Element: Scrap Rate

a. Default Values:

- 1) Intermediate Repair (WRA) - .024
- 2) Depot Repair (WRA) - .0012
- 3) Intermediate Rep (SRA) - .008
- 4) Depot Repair (SRA) - .0009

b. Source/Derivation: The default values for Intermediate Repair (WRA & SRA) were derived from 3-M Type Equipment Work Unit Code Report for the period of January 1975 through December 1977.

The default values for Depot Repair (WRA & SRA) were derived through contacts with Navy Depots.

Standard Depot Scrap Rates for SRAs and WRAs were not available and should be considered separately in each LOR analysis.

20. Data Element: Number of Trained Men

a. No default value could be determined for this number.